

## REMARKS

The official action of 12 December 2008 has been carefully considered and reconsideration of the application as amended is respectfully requested.

New claims 14-18 have been added to the application more completely to define the subject matter which Applicants regard as their invention. Claim 14 tracks the limitations in original claim 1, and further recites that the combined action of the concurrent and countercurrent ultrasonic waves have a demulsifying effect that is greater than that of the concurrent or countercurrent ultrasonic wave alone. This is supported, for example, by the experimental comparison described in the specification beginning at the bottom of page 15 to page 18. Claims 15-18 also track the recitations in the original claims, including the recitation in original claim 3 that the concurrent ultrasonic wave and the countercurrent ultrasonic wave travel with uniform sound intensity within the ultrasonic acting region.

Claims 1-13 stand rejected under 35 USC 103(a) as allegedly being unpatentable over Scott. Applicants respectfully traverse this rejection.

The claimed invention is based at least in part upon Applicants' discovery that, by providing a concurrent ultrasonic wave and a countercurrent ultrasonic wave that act simultaneously on the water-oil emulsions flowing through an ultrasonic acting region, it is possible to demulsify the water-oil emulsions to a

greater extent than is possible with the concurrent ultrasonic wave or countercurrent ultrasonic wave acting alone. This is exemplified in the specification at pages 15-18 as noted above. As discussed below, this is not possible without at least a second ultrasonic transducer provided at the downstream end of the recited ultrasonic acting region, as is required by all claims of record. As also discussed below, it is not possible to generate a uniform sound intensity in the ultrasonic acting region (see, e.g., claims 3 and 16) without at least the second ultrasonic transducer so provided.

The Examiner has acknowledged that Scott does not disclose at least a second ultrasonic transducer provided at the downstream end of the ultrasonic acting region, but contends that it would have been obvious to replace the reflector plate of Scott with a second transducer since this replacement would allegedly provide the same result. This is respectfully incorrect as discussed next.

First, Applicants respectfully note that the principle described in Scott is making a fluid mixture flow through two different sonic wave fields: in one field, the sonic waves travel in a direction perpendicular to the direction of flow of the fluid mixture; in the other field, the sonic waves travel in a direction parallel to the direction of flow of the fluid mixture so as to break any molecular bonding between a first material and a second material in the fluid mixture.

In accordance with this principle of operation, Scott discloses a reflector

opposite the first transducer that creates a countercurrent wave that acts simultaneously on the water oil emulsion and controllably forms an interference face of the wave formed by the interface between the material in the first ultrasonic acting region and the air above it (column 7 lines 12-17). The technical solution of Scott consists in realizing separation of the materials in a fluid mixture via generating cavitation waves or standing waves. For example, one embodiment of Scott specifically states that, for maximum production of cavitation waves, the vertical distance from the inner surface of the channel structure which is in contact with the core pieces 19 to the interface between the fluid mixture and the air above it should be equal to one-third the wavelength of the cavitation waves (column 7 lines 12-17).

Cavitation waves are interference waves generated when the waves in travel encounter different interfaces of mediums with wave-overlapping, resulting in generating new more intense ultrasonic wave having two times the intensity than before such that the ultrasonic wave is not uniform in the acting region. The intensity of the ultrasonic wave in the acting region sometimes is intense and sometimes is weak. The embodiment also requires, in order to produce standing waves, that the distance between the inner surface of the channel structure which is in contact with the core pieces 22 and the nearer side of the weir member 50 should be equal to a multiple(s) of one-half of the wavelength of the standing wave (column 7 lines 34-38).

Standing waves are interference waves of two arrays of waves which

travel in opposite directions and have the same frequency; when the distance is an odd multiple (number times) of a quarter of the wavelength, the two arrays of waves are mutually neutralized to a minimum and the intensity is equal to the difference between the intensities of the two arrays of waves. When the distance is a multiple(s) of half of the wavelength, the waves overlap so that the intensity is the sum of the intensities of the two arrays of waves. Therefore, standing waves also result in nonuniform ultrasonic wave which is sometimes intense and sometimes weak in the acting region.

The second transducer in the claimed invention is required to provide more uniform ultrasonic wave and to avoid (a) a poor demulsifying effect due to ultrasonic wave traveling attenuation resulting from using only one ultrasonic transducer or (b) intensified emulsification due to partial cavitation resulting from too great emission sound intensity which is required for making up attenuation in the case where only one ultrasonic transducer is used, so as to better demulsify water-oil emulsions. The claimed invention requires the concurrent ultrasonic wave and the countercurrent wave to act simultaneously, which is totally different from the effect of the ultrasonic wave generated by the transducer and the reflector as described in Scott.

In view of the above, it may be appreciated that the results that can be achieved with the claimed method using a second transducer would not have been predictable from Scott. Moreover, there is nothing in Scott to show or suggest the substitution of a second transducer for Scott's reflector. Indeed, the

modification of Scott required to arrive at the claimed invention would impermissibly change the principle of operation of Scott's invention (as discussed above) such that there could have been no motivation or reason for such modification. See MPEP 2143.01(VI) ("If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious."). Accordingly, Scott cannot be considered to render obvious the invention defined by any of the claims of record.

With particular respect to claims 2-5, the claimed subject matter is further patentably distinguishable from Scott as discussed hereafter.

The ultrasonic acting region of Scott has a channel structure. It can be determined to be a channel structure according to the drawings, and it is to provide cavitation waves and standing waves. In contrast, the cited features of claims 1 and 15 of the claimed invention require that the orientation of the central axis of the ultrasonic acting region is identical with the flowing direction in which the water-oil emulsions flow through the ultrasonic acting region; this is not a channel structure.

Since Scott uses a first ultrasonic transducer and a reflector, adjusting the distance between the reflecting surface to produce standing waves, the intensity of the ultrasonic wave in the acting region must not be uniform. In contrast, the

recited features of claims 3 and 16 require that the concurrent ultrasonic wave and the countercurrent ultrasonic wave travel with uniform sound intensity within the ultrasonic acting region.

With respect to claims 4, 5, 17 and 19 Scott does not recognize the result effective nature of ultrasonic sound intensity whereby it could not have been obvious to optimize this variable. See MPEP 2144.05(II)(B). Claim 4 and 17 require that the sound intensity of the countercurrent ultrasonic wave is not higher than  $0.8\text{W}/\text{cm}^2$ , with the aim to limit the intensity of the countercurrent ultrasonic wave and to avoid cavitation of water-oil emulsions. A countercurrent ultrasonic wave having an intensity that is higher than the claimed value will result in cavitation of water-oil emulsions, and a countercurrent ultrasonic wave having an intensity that is lower than the claimed value will result in further emulsification. Claims 5 and 19 require that the sound intensity of the concurrent ultrasonic wave is not higher than  $0.5\text{W}/\text{cm}^2$ , with the aim to limit the intensity of the concurrent ultrasonic wave and avoid cavitation of water-oil emulsions. In contrast, Scott teaches the need for cavitation and thus teaches away from this claim feature.

With particular respect to claim 7, Scott defines that the top of the channel structure is open (column 2 lines 50-53); but the demulsifying device defined by claim 7 is characterized in that the ultrasonic acting region is of a pipe structure and is connected with other water-oil emulsion pipes in production and processing line. Therefore it must be closed in this situation. With respect to

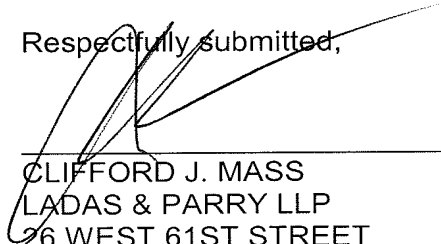
ultrasonic action, a pipe structure and a channel structure are different and will produce totally different technical effects.

The demulsifying device defined by claim 8 is characterized in that the ultrasonic acting region is a pipe structure with a constant diameter; the demulsifying device defined by claim 9 is characterized in that the ultrasonic acting region is a pipe structure with a varying diameter. Scott does not teach or suggest the features such that the invention claimed in claims 8 and 9 is further distinguished from Scott on this basis.

Claims 10-13 limit the intensity of the countercurrent ultrasonic wave and avoid cavitation of water-oil emulsions. A countercurrent ultrasonic wave having an intensity that is higher than this value would result in cavitation of water-oil emulsions, while a countercurrent ultrasonic wave having an intensity that is lower than this value results in further emulsification. For reasons discussed above, Scott teaches away from the claimed value.

In view of the above, Applicants respectfully submit that the prior art rejection of record has been overcome and that the application is now in allowable form. An early notice of allowance is earnestly solicited and is believed to be fully warranted.

Respectfully submitted,



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